



VR-Forces 4.7 Release Notes

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Systems Supported

VR-Forces 4.7 is available for the platforms listed in [Table 1](#). For toolkit users, application code must be built with the indicated compilers in order to link to VR-Forces libraries.

Table 1: Platforms supported

Operating System	Compiler
Windows 10	Microsoft Visual C++ 15.0 (64 bit)
Red Hat Enterprise Linux 7 (64 bit libraries)	default compiler

3D Video Cards Supported

VR-Forces 4.7 supports NVIDIA graphics cards that support OpenGL 4.5 VR-Forces does not support AMD (formerly ATI) graphics hardware.



VR-Forces strives to provide the best 3D scene quality possible and cutting edge visualization effects. To provide this functionality, VR-Forces takes advantage of OpenGL features that may not be supported on older video cards. When this is the case, you can disable these features, allowing VR-Forces to run in 3D modes.

OpenGL 4.5 is the minimum requirement for rendering a 3D scene in VR-Forces. For the best visual quality and highest performance you should use the most recent NVIDIA GeForce card. The minimum recommended card is the 9xx series.

Some laptops have an NVIDIA graphics card and an Intel graphics card. You must configure your computer to use the NVIDIA card. To do so:

1. Open the NVIDIA Control Panel (in the System Tray).
2. Select Manage 3D Settings.
3. Select Global Settings.
4. Select Preferred Graphics Processor.
5. Select High-performance NVIDIA Processor.



You should always try to use the latest drivers available for your video board.

Using Kepler Series Quadro Cards

There is a known issue with the Quadro drivers on Kepler series Quadro cards. NVIDIA says its related to the fact that the default profile optimizes for a fixed eyepoint (for applications like CAD). To run on these cards, you must change the global profile for the driver, as follows:

1. Open the NVIDIA Control Panel.
2. Select the Manage 3D Settings page.
3. Select the Global Settings tab.
4. In the list of driver profiles, select Workstation App - Dynamic Streaming.

We are working with NVIDIA to have their drivers recognize our applications and apply this profile automatically. In the meantime, Kepler series Quadro you must make this change manually.

Disk Space Requirements

A full installation of VR-Forces requires approximately 15 GB of disk space.

Compiler Compatibility on Windows

MAK provides versions of product releases that have been compiled with different versions of Microsoft Visual C++ (for example, 12.0, and 15.0). When you run MAK products together on the same computer, for example, VR-Forces and VR-Vantage Stealth, we strongly recommend that you run versions compiled with the same compiler. Mixing products compiled with different versions of the compiler can result in program instability.

Required Software for Toolkit Users

If you plan to build VR-Forces applications using the VR-Forces Toolkit, you must download and install VR-Link 5.4.1. You can download it from:

- <http://ftp.mak.com/out/vrlink5.4.1-win64-vc14.exe>
- <http://ftp.mak.com/out/vrlink5.4.1-linux64-rhe7.tar.gz>

If you plan to build the VR-Forces GUI, you must download and install QT 5.10.1 (Windows) or 5.6.3 (Linux). You can download it at: <http://www.mak.com/support/bonus-material>.

Qt is also available as a free download under the LGPL version 2.1 license at qt.digia.com. This version should be satisfactory for most VR-Forces customers. If you need a Qt commercial license, you must purchase the license from Digia.

MAK Product Compatibility

To build VR-Forces applications, you must link with VR-Link 5.4.1. If you are building for HLA and want to link with the MAK RTI, use MAK RTI 3.x or later, although we recommend use of the latest release. If you are building for HLA Evolved, you must use MAK RTI 4.0.4 or later.

License Manager

VR-Forces 4.7 uses FLEXlm 11.13.0.2.

The License Manager files are not part of the VR-Forces installer. You can download them at:

- ♦ Windows: <http://ftp.mak.com/out/MAKLicenseManager-win64-setup.exe>
- ♦ Linux: <http://ftp.mak.com/out/MAKLicenseManager-linux64-setup.tar.gz>

A license manager FAQ is available at:

<http://www.mak.com/license-support.html>

Third Party Library Support

VR-Forces 4.7 uses the indicated versions of the following libraries:

- ♦ VR-Link 5.4.1
- ♦ Qt 5.10.1 (VC 15), Qt 5.6.3 (Red Hat 7)
- ♦ OpenSceneGraph 3.4.0
- ♦ Boost 1.46.1
- ♦ FreeGlut 2.4.0
- ♦ GL-Studio 5.1.2 (VC 15)
- ♦ DI-Guy 13.3 (development version)
- ♦ Triton 3.73
- ♦ Silverlining 5.005
- ♦ SpeedTree 6.3.2
- ♦ CDB API 2.2 (Windows), 2.1 (Linux)
- ♦ osgEarth 2.9.0
- ♦ CUDA 9.2 (Windows), 9.1 (Linux).

Using MAK Products on Virtual Machines

In general, MAK products run on virtual machines (VM) without any problems. The exception to this statement is that applications that use 3D graphics, such as VR-Vantage and the VR-Forces front-end, require a graphics card. Standard graphics cards typically do not work with VMs. To use a 3D enabled environment in a VM, please contact your VM vendor for options. NVidia produces the NVidia GRID card, which is designed to solve this problem. Your VM vendor may have additional information. For more information on NVidia GRID, please see <http://www.nvidia.com/object/virtual-gpus.html>

Network Compatibility

VR-Forces 4.7 is compliant with RPR FOM 1.0 and RPR FOM 2.0 and includes FOM mappers for many draft versions of the RPR FOM. It is compliant with RTIs that support the HLA 1.3 specification, the SISO DLC HLA API 1516 version of the IEEE 1516 specification (SISO-STD-004.1-2004), or HLA Evolved.

To use an RTI with VR-Forces it must use the same operating system and be built with the same compiler.

VR-Forces 4.7 supports DIS 4, 5, 6, and 7, and can therefore interoperate with DIS applications of any of these versions.

Backwards Compatibility

The VR-Forces 4.7 APIs are not compatible with VR-Forces 3.x or earlier. It is largely compatible with the 4.3.x API and later. Small changes may be necessary to migrate from 4.5.

Scenarios created with recent releases are usually forward compatible. However, changes to tasks, systems, and terrain reasoning may change how simulation objects behave.

Support for MAK Data Logger Recordings

The recordings provided with MAK Data Logger 5.4 or later use the new FED file naming conventions (described in *MAK Products Interoperability Guide*). These should work seamlessly with the default HLA configurations in VR-Forces 4.7. If you want to connect VR-Forces 4.7 to recordings made with previous versions of the Logger, you must change the connection configuration to use the old FOM naming convention.

RPR FOM Versions Supported

VR-Forces 4.7 has built-in support for versions 1.0 and 2.0 (drafts 6, 17, and 20) of the RPR FOM and RPR FOM 2.0, draft 17 with DI-Guy extensions. It also supports VR-Link's ability to support alternative FOMs through the FOM Mapper. By default, VR-Forces 4.7 uses RPR FOM 2.0.

If you are building an application with the VR-Forces toolkit and you want to specify a version of the RPR FOM through code, pass the version number (for example, 2.0006) to the *DtFedAmbWrapper* constructor and pass the resulting object to the *DtExerciseConn* constructor. Also, make sure you are using a federation execution name that corresponds to the right FED file. For example:

```
DtExerciseConn conn("VR-Link20006", "MyApp", new DtRprFomMapper(2.0006));
```

In order to support RPR FOM 1.0, we have added the following extensions (which are supported in later versions of the RPR FOM):

- ♦ EnvironmentProcess
- ♦ GriddedData
- ♦ EmbeddedSystem.IFF
- ♦ EmbeddedSystem.IFF.NatoIFF
- ♦ EmbeddedSystem.IFF.NatoIFF.NatoIFFTransponder
- ♦ EmbeddedSystem.IFF.NatoIFF.NatoIFFInterrogator
- ♦ EmbeddedSystem.IFF.SovietIFF
- ♦ EmbeddedSystem.IFF.SovietIFF.SovietIFFTransponder

- ♦ EmbeddedSystem.IFF.SovietIFF.SovietIFFInterrogator
- ♦ EmbeddedSystem.IFF.RRB
- ♦ BaseEntity.AggregateEntity
- ♦ ObjectRoot.BaseEntity.PhysicalEntity.Lifeform.

For both RPR FOM 1.0 and 2.0 VR-Forces 4.7 relies on the Controlling and ViewControl custom MAK extensions.

New Features and Updates

VR-Forces 4.7 has the following new features and updates.

Easier Configuration

- ♦ Significant changes to the Simulation Object Editor, as follows:
 - Attributes are now grouped more logically.
 - You can now create and edit weapon and damage systems.
 - Munitions are listed on a separate tab from other simulation objects and you can configure their damage power.
 - You can compare platform configuration and probability of kill rates to figure out why one entity type cannot kill a different entity type.
 - Configuration errors are flagged and a wizard is provided to walk you through fixing them.
- ♦ In the Simulation Object Editor you can now configure an animation and ingress and egress techniques for embarking entities.
- ♦ As part of adding the ability to edit systems to the Simulation Object Editor, there significant changes to weapon and damage systems. The information that was previously configured in ammunition select files, hit tables, and damage files is now part of the weapon system system definition file. The configuration files used in previous versions of VR-Forces are still supported. The OPD Editor is no longer provided.
- ♦ The audio system has been completely revised to make it more intuitive and easier to change how sounds are configured in the front-end. This includes both the underlying code and how sound effects are configured. For details, please see Chapter 49, [Sound Effects](#), in *VR-Forces Users Guide*.

Improved Modeling

- ♦ Support for humans to open and close car doors and get in and out of cars. This capability is built into the Embark task. These actions use DI-Guy Animations. Humans that are configured for these animations automatically use them to enter and exit vehicles that are configured with the needed articulated parts and slots. (The animations for drivers do not support drivers on the right side of cars, such as in the United Kingdom.) For details, please see Section 29.1.4, [“Embarking Humans in Cars,”](#) in *VR-Forces Users Guide*. The following human characters support these animations:

- Western Soldier (soldier_07)
- Western Male Pedestrian (mped_07)
- Western Female Pedestrian (fped_07)
- Middle East Male Pedestrian (mideast_mped_07).
- ♦ Ballistic missile weapon system. Missile launchers can launch ballistic missiles without the need of a CSV file. (CSV-controlled missiles are still supported.)
- ♦

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The Ballistic Missile tasks do not use physics-based modeling. They calculate a simple parabola for the trajectory and move the missile along the trajectory ignoring atmospheric, thrust stages, cargo weight, gravity, and the rotation of the earth.

- ♦ Support for satellites flying geostationary orbits or Kepler orbits. Satellites can sense ballistic missiles and relay data to ground forces. For details, please see Section 34.42, “[Orbit](#),” in *VR-Forces Users Guide*.
- ♦ Improved anti-ballistic missile systems.
- ♦ Close-in weapon system for naval entities.
- ♦ Support for Nav Edges. Navigation edges are tactical graphics that affect the navigation mesh in a navigation area. They permit VR-Forces to calculate paths to locations that an entity would otherwise not be able to move to. For example you could create a nav edge that lets an entity walk to a roof of a building with no interior geometry, or tunnel under a street. For details, please see Section 40.4, “[Creating Nav Edges](#),” in *VR-Forces Users Guide*.

Front-end Improvements

- ♦ You can now take screen captures with a keyboard shortcut. The default directory for saving them has changed. For details, please see Section 4.2.3, “[Taking Screen Captures](#),” in *VR-Forces Users Guide*.
- ♦ The Objects List Panel and Order of Battle Panel now have a search capability.
- ♦ The Time Scale toolbar now defaults to discrete time increments. You can still use a slider if you wish. For details, please see Section 7.6.1, “[Changing the Simulation Speed](#),” in *VR-Forces Users Guide*.
- ♦ You can now specify that objects using a particular OPE file not include certain set data requests on the Set menu. For details, please see Section 84.4.2, “[Editing the Set Menu](#),” in *VR-Forces Users Guide*.
- ♦ You can now add new menus and submenus to the GUI without writing code. You are still restricted to the menu items available in code. For details, please see Section 84.2.2, “[Creating New Menus](#),” in *VR-Forces Users Guide*.
- ♦ When you save a scenario, the visible/hidden and locked/unlocked states of overlays get saved.
- ♦ You can now hide the exit prompt. For details, please see Section 4.6.1, “[Disabling the Quit Prompt](#),” in *VR-Forces Users Guide*.

Improvements for Users of Multiple Back-ends

- ♦ You can now close all back-ends when you exit VR-Forces instead of only the back-end that started up with the front-end in combined mode. For details, please see Section 4.6, “[Exiting VR-Forces](#),” in *VR-Forces Users Guide*.
- ♦ You can now start missing back-ends from the GUI if you load a scenario that uses multiple back-ends and some are not available. For details, please see Section 7.5.2, “[Loading a Load-Balanced Scenario](#),” in *VR-Forces Users Guide*.
- ♦ When you rewind a scenario, all back-ends automatically pause. Previously if you did not explicitly pause the scenario before rewinding, it would immediately start to run again. Now you must explicitly run the scenario.

Aggregate-Level Simulation

Many updates to aggregate-level simulation, including:

- ♦ Updated air to air combat model.
- ♦ Updated surface to air combat model.
- ♦ Calculation of fuel use based on altitude and speed.
- ♦ New concepts of airframe and loadout for air units.
- ♦ Air bases.
- ♦ Refueling capability.
- ♦ Enhanced radar and IFF.

For details, please see Section 22.5, “[Air Combat](#),” and air mission sections, in *VR-Forces Users Guide*.

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Aggregate-level scenarios created with VR-Forces 4.6.1 or earlier that include air units might not work as expected due to the changes in this release.

Tactical Graphics

- ♦ Engagement zone tactical graphics. For details, please see Section 9.5, “[Engagement Zones](#),” in *VR-Forces Users Guide*.
- ♦ Visualization of aerial radar coverage in 2D and 3D. For details, please see Section 9.7, “[Radar Coverage](#),” in *VR-Forces Users Guide*.
- ♦ Support for cloud layer tactical graphics. For details, please see Section 40.5, “[Creating Cloud Layers](#),” in *VR-Forces Users Guide*.

Tasks and Sets

- ♦ Support for executing multiple instances of a Lua task at the same time. For details, please see Section 31.2.12, “[Configuring Scripted Tasks to Run Concurrently](#),” in *VR-Forces Users Guide*.

- ♦ You can now specify whether or not the description of a scripted task or set is included in the task or set dialog box.
- ♦ A new plan command - Send Text Message, sends text messages that do not use the radio network. They can be sent between forces and they do not display communication lines or squawks. Otherwise, it works like the Send Text Message task. For details, please see Section 37.7.2, “[Sending Text Messages from the Commands Menu](#),” in *VR-Forces Users Guide*.
- ♦ New tasks:
 - Lase location. For details, please see Section 27.12, “[Lase Location](#),” in *VR-Forces Users Guide*.
 - Land at Air Base. Task an aircraft unit to land at an air base. For details, please see Section 30.50, “[Land at Air Base](#),” in *VR-Forces Users Guide*.
 - Launch Flight. Task an air base to launch a flight of aircraft. Aggregate-level scenarios only. For details, please see Section 30.51, “[Launch Flight](#),” in *VR-Forces Users Guide*.
 - Escort Air Unit. Task an air unit to escort another unit. For details, please see Section 30.40, “[Escort Air Unit](#),” in *VR-Forces Users Guide*.
 - Wait for Escort. Task an air unit to wait at a location until an escort joins it. For details, please see Section 30.71, “[Wait for Escort](#),” in *VR-Forces Users Guide*.
 - Orbit Object. Causes an aircraft to orbit a simulation object or point tactical graphic. For details, please see Section 26.26, “[Orbit Object](#),” in *VR-Forces Users Guide*.
 - IFF Code Changer. This reactive task changes the IFF code every half hour for aircraft that have the IFF Code Changer system.
 - Launch Ballistic Missile at Location. Available to entities that have a Strategic Missile Launcher weapon system. For details, please see Section 27.15, “[Launch Ballistic Missile at Location](#),” in *VR-Forces Users Guide*.
 - Launch Ballistic Missile at Target Object. Available to entities that have a Strategic Missile Launcher weapon system. For details, please see Section 27.16, “[Launch Ballistic Missile at Target Object](#),” in *VR-Forces Users Guide*.

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The Ballistic Missile tasks do not use physics-based modeling. They calculate a simple parabola for the trajectory and move the missile along the trajectory ignoring atmospheric, thrust stages, cargo weight, gravity, and the rotation of the earth.

- Air-to-Ground Air Base Attack. Causes an aircraft unit to attack an air base. For details, please see Section 30.4, “[Air-to-Ground Air Base Attack](#),” in *VR-Forces Users Guide*.
- Open Car Door and Close Car Door. If a vehicle has a Car Door system and its visual model includes articulated parts for the doors, you can open and close the doors. For details, please see Section 29.4.5, “[Open Car Door](#),” and Section 29.4.1, “[Close Car Door](#),” in *VR-Forces Users Guide*.

- ♦ New sets:
 - Orbit. Specifies the orbit of a satellite entity. For details, please see Section 34.42, “[Orbit](#),” in *VR-Forces Users Guide*.
 - Engagement Zone. Associates an engagement zone with a simulation object. For details, please see Section 34.23, “[Engagement Zones](#),” in *VR-Forces Users Guide*.
 - Rules of Engagement. New option: Fire When In Engagement Zone. Sets ROE to fire at will if the target is in an engagement zone that is associated with the firing simulation object. For details, please see Section 34.52, “[Rules of Engagement](#),” in *VR-Forces Users Guide*.
 - Set Assume Unknown is Hostile. Specifies that an unidentified simulation object in an engagement zone that is associated with the firing simulation object should be treated as a hostile object. For details, please see Section 34.8, “[Assume Unknown is Hostile](#),” in *VR-Forces Users Guide*.
 - Assign Aircraft. Assign aircraft to an air base. Aggregate-level scenarios only. For details, please see Section 35.4, “[Assign Aircraft](#),” in *VR-Forces Users Guide*.
 - Facilities. Set quantity of air base capacities, such as runways, fuel capacity, and barracks. Aggregate-level scenarios only. For details, please see Section 35.17, “[Facilities](#),” in *VR-Forces Users Guide*.
 - Personnel and Supplies. Specifies the number of air crew, ground crew, munitions, and aviation fuel for an air base. Aggregate-level scenarios only. For details, please see Section 35.32, “[Personnel and Supplies](#),” in *VR-Forces Users Guide*.
 - Hide Occupants. Overrides the Show Occupants setting on the Entity Display Settings page. For details, please see Section 34.27, “[Hide Occupants](#),” in *VR-Forces Users Guide*.
 - Attention Grabbing. Specifies how attractive the object is to humans when they randomly look at other entities. For details, please see Section 34.9, “[Attention Grabbing](#),” in *VR-Forces Users Guide*.
 - Set Laser Power and Wave Length lets you set the power and wave length for laser designators. For details, please see Section 34.35, “[Laser Power and Wavelength](#),” in *VR-Forces Users Guide*.
 - Set Sensor Field of View Color lets you specify the color of sensor field of view cones for sensors such as gimbaled sensors. For details, please see Section 34.57, “[Sensor Field of View Color](#),” in *VR-Forces Users Guide*.
 - Set Preferred Trajectory Height specifies a preferred trajectory for indirect fire. For details, please see Section 34.45, “[Preferred Trajectory Height](#),” in *VR-Forces Users Guide*.
 - Stow Hand Item lets you hide and redisplay hand items for human characters. For details, please see Section 34.61, “[Stow Hand Item](#),” in *VR-Forces Users Guide*.

Terrain

- ♦ Support for exporting props to shapefiles. For details, please see Section 57.6.9, “[Exporting Props and SpeedTrees to a Shapefile](#),” in *VR-Forces Users Guide*.
- ♦ Support for importing props and SpeedTrees from shapefiles. For details, please see Section 57.6.10, “[Importing Props and SpeedTrees from Shapefiles](#),” in *VR-Forces Users Guide*.
- ♦ The earth file configuration has changed for Aerodrome layers. They are no longer a model layer and are now an aerodromes layer. See `./user-Data/servers/airports.worldwide.xml` for an example of the new aerodromes layer configuration.
- ♦ VR-Forces entities can now use the road networks in Open Street Map terrains.
- ♦ Support for changing layer properties at runtime using the osgEarth Profile tool. For details, please see Section 64.3, “[Debugging Earth Files](#),” in *VR-Forces Users Guide*.
- ♦ LOD Blending. Models that use indirect rendering can blend LODs as they transition between different states.
- ♦ Procedural Terrain Blending. Procedural terrain now supports `min_range`, `max_range`, and `attenuation_distance` in splatting layers. You can now configure terrain to show pure imagery in the distance, pure procedural imagery close in, and a blend in-between.
- ♦ The new `cdbtool` lets you cache CDB models and textures offline. For details, please see Section 60.4, “[Caching CDB Data \(cdbtool\)](#),” in *VR-Forces Users Guide*.
- ♦ Improvements to the California (online) terrain.
- ♦ Added Edwards Air Force Base runways to the California terrain
- ♦ VR-Forces can now load EGM elevation data using an earth file. For details, please see Section 59.10, “[Referencing an Earth Gravitational Model \(EGM\)](#),” in *VR-Forces Users Guide*.

Visual Modeling Changes

- ♦ Updated civilian vehicle models, including some with interior geometry and doors that open.
- ♦ New T-38 Trainer jet.
- ♦ You can now jump directly between simulation object type mappings in the Simulation Object Type Mappings dialog box and their associated element definitions in the Visual Model Editors dialog box. You can also jump between element definitions and model definitions.
- ♦ The Schemas page and Model Definitions page in the Visual Model Editors dialog box now have a search capability that lets you filter the list using a text string.
- ♦ The Simulation Object Type Mappings dialog box now lets you filter the list using a text string.

- ♦ Added support for saving individual interaction definitions and tactical graphics definitions in the Visual Models Editor.
- ♦ Support for DI-Guy drivers in vehicles. These entities are just for visualization. They do not represent simulated entities unless a simulation application publishes an embarked entity in the driver's position. For details, please see Section 44.4, "[Displaying DI-Guys in Vehicles](#)," in *VR-Forces Users Guide*.
- ♦ The following 3D models now have articulated doors that can open and close using the Open Car Door and Close Car Door tasks and when humans embark on them:
 - Sport Standard Size Sedan
 - Sport Hatchback Coupe
 - Police Cruiser (Chevy)
 - Taxicab
 - Chevrolet Caprice.
- ♦ Support for LOD scaling.
- ♦ Added a new Near/Far Clipping Policy, "Clamp Near Clip When Magnified". It is the same as Reduce Z Fighting, but adds an intersector to clamp the near clipping plane to prevent the near clip from going past objects or terrain in the scene when using view magnification. The intersector is only used when view magnification is 2x or more (this value can be changed through the API by extending the channel and overriding the call that calculates the clamp). This is an expensive operation, so only enable it if you really need it. For details, about Near/Far clipping policies, please see Section 82.4.1, "[Setting the Clipping Planes](#)," in *VR-Forces Users Guide*.
- ♦ You can configure cloud covers and their cloud layers. For details, please see Section 11.6, "[Creating and Editing Cloud Covers](#)," in *VR-Forces Users Guide*.
- ♦ You can now override the default lighting settings for CameraFX to provide a more realistic view of terrain and entities when using IR or NVG. You can adjust the amount of ambient and diffuse light and the intensity of light emitted by DI-Guys and other entities. For details, please see Section 47.3, "[Configuring Sensors](#)," in *VR-Forces Users Guide*.

Performance

- ♦ Support for making occlusion queries. For details, please see Section 64.8, "[Enabling Occlusion Queries](#)," in *VR-Forces Users Guide*.
- ♦ Greatly improved caching for streaming and CDB terrains - allows for much faster terrain loads.
- ♦ Reduced stalls for loading terrains.
- ♦ Improved preloading of entities and eliminated stalls associated with new entity creation.
- ♦ Added the ability to specify effects textures in .osg files (so we can use effect textures with particle systems).
- ♦ Updated to Silverlining 5.40.

- ♦ Added ImGui controls for overriding the sun/moon position. This position is basically just a small vector in ENU which specifies the relative location of the sun/moon to any point in the scene. The direction of the light is just the negative of all three components of the vector. Used for debugging what a model would look like if the light is in a different direction. For details, about ImGui please see Section 6.17, [“Using the Developer Debug Overlay,”](#) in *VR-Forces Users Guide*.
- ♦ Added ImGui sliders for controlling the observer location.
- ♦ Added support for cloud smoothing. This smooths the cloud along the intersections of clouds with any other object. The cloud drawable is now copying the depth buffer to a texture before it starts rendering the clouds. The new effect is controllable using an ImGui checkbox and slider. Also fixed a minor issue with how the fog height was calculated so that it does not take into account cloud layers that are not currently enabled.
- ♦ Significant improvements in performance through use of indirect rendering:
 - You specify the use of indirect rendering when you load a terrain patch or terrain server. Please see Section 64.5, [“Indirect Rendering,”](#) in *VR-Forces Users Guide* for an introduction to indirect rendering.
 - If use of indirect rendering produces visual artifacts that were not present in previous releases, you can disable indirect rendering for specific nodes in an OpenFlight file. For details, please see Section 90.12, [“Disabling Indirect Rendering for an OpenFlight Model,”](#) in *VR-Forces Users Guide*.
 - Indirect rendering now works with extruded and point-feature-replaced features using `feature_geom` and for extruded and point feature replaced features using the Buildings driver. Use of `feature_custom` is deprecated. For details, please see Section 59.5, [“Processing Streamed Data,”](#) in *VR-Forces Users Guide*.

API Changes

- ♦ The VRF 4.2.x compatibility header files have been removed. It is now necessary to include the correct VRF 4.7 header file names.
- ♦ The following examples have been renamed to better reflect what they show:
 - `addActuator` is now `modifySimComponent`
 - `addPsr` is now `addSimComponent`
- ♦ A number of “reader-writer” classes have been moved out of the `vrutil` library and into a new library called `readerWriter`. This includes the base classes for the reader-writer system, and the basic types. Any code including these header files will need to have the include path changed to the new directory name.

- ♦ Simulation commands that execute methods now take a context pointer which can be used to delay the execution of simulation commands. This was necessary to allow for the create object command to wait until the terrain was paged in before creating the entity. The simulation context can be filled in with data that can indicate the simulation command has not yet been completed. The `isSimCommandComplete()` method is then called with that context to see if the command has been completed. If it has then that method can return true. So, for example, if you have a simulation command and the execute methods looked like:

```
bool MySimCommandExecutor::execute(const DtSimCommand* command, const DtPlan*)
```

```
bool MySimCommandExecutor::execute(const DtSimCommand* command, const DtUUID& objectName, const DtPlan*)
```

They must now look like:

```
bool MySimCommandExecutor::execute(const DtSimCommand* command, DtSimCommandContextPtr &, const DtPlan*)
```

```
bool MySimCommandExecutor::execute(const DtSimCommand* command, DtSimCommandContextPtr &, const DtUUID& objectName, const DtPlan*)
```

If you do not make those changes your simulation command will not work.

- ♦ The prototype for the remapping function has changed from `(DtBackendMap* map, void* usr)` to `(DtBackendMap* map, const std::set<DtSimulationAddress>& expectedBackends, void* usr)`; to allow the remapping function to also know what back-ends the scenario is expecting to be there.
- ♦ It is no longer necessary to create RW variables for scripted task message parameters. For example, a selection parameter used to be defined like this:

```
DtRwInt* p1RwVar = new DtRwInt("p1_selection");  
*p1RwVar = 2;  
task.variables().addVariable(p1RwVar);  
task.variableDataTypes().addVariable(new DtRwString("p1_selection", DtScriptedTaskIntegerVariable));
```

It is now defined simply as:

```
task.setValue("p1_selection", 2);
```

You can find a complete list of the parameter types that are possible for the overloaded `setValue` function in `vrTasks/scriptedTaskTask.h`.

Documentation Updates

Documentation has been updated for this release.

Fixed Bugs

The following problems identified in previous releases have been fixed:

- ♦ Entities could drive way off roads if road made turns beyond capability of entity. 60555
- ♦ If you created a tactical graphic such as an area at the equator then dragged it to to the poles on a geocentric terrain the area changed its shape. 62106

- ♦ The altitude reported in the Last Selected Object Panel sometimes got stuck on the wrong altitude. 62281
- ♦ Follow behavior did not work correctly for rotary wing entities. 62316
- ♦ On Linux, sometimes right click to cancel was seen as mouse look and did not cancel. 62541
- ♦ Entities got stuck below the terrain if there was a crack in the terrain. 62823
- ♦ Fleeing entities would pinball between different locations in object rich areas. 62855
- ♦ Rotary-wing entities stopped about 2 meters above waypoints when given a move to waypoint task. 62925
- ♦ Rotary-wing entities did not obey ordered speed when executing a move along task. 63068
- ♦ Some objects incorrectly took collateral damage from nearby gun detonations. 63081
- ♦ In a plan, editing a pasted task changed the original task. 63087
- ♦ In aggregate level scenarios, if a unit took damage from an engineering object, it displayed a Lua error. 63122
- ♦ The Simulation Object Editor saved full paths to included SMSs rather than relative paths. 63136
- ♦ If you placed a waypoint in the ravine area of the Bdesign3dNevada terrain and did not move the mouse, the GUI crashed. 63139
- ♦ Entities did not clamp to the surface of an LCAC the first time it changed its state from still to moving. 63165
- ♦ The M26 rocket did not have detonation power configured. 63196
- ♦ The Fire Cruise Missile dialog box did not allow you to set speeds greater than 3240 km/h. 63211
- ♦ When creating a custom plan for a spawn pattern, it was not possible to drag statement to the top of a trigger. 63214
- ♦ The di-guy-enabled flag was not set to false when switching away from DI-Guy visual. 63227
- ♦ Missile launchers did not check altitude. 63296
- ♦ Fixed some problems with parameters in the createAggregate() function in the remote control API. 63320
- ♦ Task complete callbacks were only called when a transmitter was specified. 63346
- ♦ Forcing a scenario to close did not cause the SMS to be reloaded if the scenario was reloaded. 63347
- ♦ Objects were being published even if the GUI was set to only create them locally. 63354
- ♦ Under certain circumstances, VR-Forces opened two terrain profile windows for the same object. In that case one window had incorrect data. 63371
- ♦ If you created an entity from a global plan on a paged terrain, and then immediately issued a plan to that entity, the plan did not get issued. 63378
- ♦ Aircraft that were on the ground or embarked deployed chaff and flares if they detected a hostile missile. 63481

- ♦ In plan view mode, if you clicked a unit in the objects list to snap the window to the unit, the view changed to a pole and spun around. 63495
- ♦ If you changed the units used to display altitude, the Set Altitude dialog box did not change the unit it used. 63518
- ♦ It was possible to create circular dependencies in the scripted task menu system. VR-Forces now issues a warning if it detects this. 63557
- ♦ Zoom to extents did not work if a scenario was not loaded. 63609
- ♦ Fixed several problems with ballistic missiles. 63645
- ♦ In Lua scripts, the getName() function did not translate the name to a UUID when sending it to a task. 63695
- ♦ If a trigger was the last statement in a plan, it would repeat even if it was not set to repeat. 63712
- ♦ If the last statements in a plan were a trigger followed by a set statement, if the trigger fired, the set got sent again. 63722
- ♦ Illumination flares did not get removed after they struck the ground. 63728
- ♦ Setting extended labels in a *DtCreateObjectCommand* caused the scenario to be saved incorrectly. 63794
- ♦ Terrain avoidance checks for aircraft caused poor performance. 63795
- ♦ Added ability, via VR-Link, to send attribute PDUs without bundling. 63854
- ♦ Fixed a problem in which a DI-Guy doing an animation on a surface ship fell off. 63956
- ♦ If you gave a surface entity a patrol between task in a plan and you deleted the first point, vrfSim crashed. 63989
- ♦ If you copied a Register Trigger statement from a plan and pasted it into the trigger body of another plan, when click started to play the scenario, vrfGui crashed. 63991
- ♦ If objects were copied or imported from one scenario to another and their plans referenced scenario events that were not in the new scenario, trying to edit a trigger that referenced one of these events caused a crash. 64025
- ♦ If a parent object and subordinate had the same marking text, VR-Forces crashed when you tried to load the scenario. 64026
- ♦ The organization manager used marking text which led to a variety of problems. 64041
- ♦ If you deleted the default window layout, the next layout in the list became the default. 64058
- ♦ Cannot set initial global weather on new scenario using remote controller. 64083
- ♦ The auto connect buttons in the launcher were not translated. 64094
- ♦ vrfSim console now works properly on Windows 7 when started from the vrfLauncher. 64101
- ♦ The sensor end arrow in 3D was too large and could not be turned off. 64121
- ♦ Task visualization for fixed-wing terrain avoidance sent too many updates. 64153
- ♦ The wait controller was in a movement system. It was moved to the OPE files to be available to all simulation object types. 64163

- If you created a plan that had a condition that tested for DI-Guy Appearance Check, after you closed the scenario and re-opened, the appearance in the condition was wrong - it was the first one listed in the list of appearances. 64190
- Tactical graphics disappeared if you edited them to be unpublished and then later published. 64393
- Dragging the terrain with the mouse unintentionally created objects when in create mode. 64394
- Fixed *DtVrfApp* to allow for easier customization and merging. 64427
- When formatting the vertex list of creation of a tactical graphic it only ever showed geocentric (not whatever the location format the user selected). 64462
- After breaching a barbed wire obstacle, units got stuck or VR-Forces crashed. 64464
- VR-Forces crashed when receiving an unknown object type for a unit. 64489
- When following another entity, fixed-wing entities sometimes generated Not A Number messages due to passing negative values to a square root. 64510
- If another application was publishing aggregates, the back-end printed a bunch of warning messages to the console. 64512
- Spot reports were sent continuously for destroyed entities. 64513
- `--loadPlugin` command line argument failed if a path had spaces in it. 64532
- Changing a DI-Guy head in the Simulation Object Editor also changed the hand item. 64550
- If a tactical graphic had `canEmbark` enabled, trying to change the altitude of all points did not work. 64563
- Improved the tab order in Edit dialog boxes. 64868
- Tooltips were not displayed if a panel or dialog box had focus. 64908
- The simulation engine did not always respond to close scenario messages. 64957
- Spot reports did not always show the correct “reported by” information. 64966
- The title bar did not include the full name of checkpointed scenarios. 64967
- There was no error checking for probability coefficient functions. 65030
- VR-Forces crashed if the current vertex value was greater than the number of points in a route. 65127
- It was possible for the index of a point in a route to be greater than the number of points in the route. 65128
- Planes crashed and teleported if flown near 0,0 latitude/longitude. 65134
- Default speed for aggregated units was too high. 65194
- Navigation Lab did not show green path lines. 65205
- Fixed dead reckoning problem when using absolute timestamps. 65277
- Force colors did not change in the Objects List Panel when loading an SMS that had different colors. 65284
- Dragging plan statements did not always work. 65426

- ♦ !Task Catalog.html and !Set Catalog.html were missing from the Linux release. 65431
- ♦ Lua function SimObject:getHeightAboveTerrain() no longer performs a blocking terrain call. It returns a second value indicating if terrain data was paged in instead of waiting for it to page in. 65483

Known Problems

- ♦ Feature indexing for model layers in osgEarth terrains is not supported by VR-Forces and must be disabled on all model layers to avoid performance issues and the possibility of crashes:

```
<model>
  <feature_indexing enabled="false"/> <!-- include this with every model
    section for VR-Vantage. If enabled, feature_indexing causes performance
    issues and crashes on Linux -->
  <!-- rest of model layer setup here-->
</model>
```

